December 1, 1856.

ANNIVERSARY MEETING.

The LORD WROTTESLEY, President, in the Chair.

Dr. Tyndall reported, on the part of the Auditors of the Treasurer's Accounts, that the total receipts during the last year, including £360 arising from the sale of a portion of the Acton Estate, and £200 bequeathed by the late Henry Lawson, Esq., F.R.S., amounted to £3780 3*s*. 1*d*., and that the total payments in the same period, including £560 invested in the Funds, amounted to £3643 8*s*. 10*d*., leaving a balance due by the Treasurer to the Society of £136 14*s*. 3*d*.

The thanks of the Society were voted to the Treasurer and Auditors.

List of Fellows deceased since the last Anniversary.

On the Home List.

Hon. George Charles Agar, M.A.
James, Earl of Bandon.
Rear-Admiral Frederick William Beechey.
Sir William Edward Rouse Boughton, Bart.
Very Rev. Wm. Buckland, D.D.
Wm. Frederick Chambers, M.D.
Sir Alexander Crichton, M.D.
Sir George Duckett, Bart., M.A.
Charles Elliott, Esq.
Right Hon. Henry Goulburn.
George James Guthrie, Esq.
Rev. John Philip Higman.
Admiral Philip Parker King.
John Fletcher Miller, Esq.
Henry Charles, Duke of Norfolk.
Sir Benjamin Outram, M.D.
William Hasledine Pepys, Esq.
John Urpath Rastrick, Esq.
John Reeves, Esq.
James Meadows Rendel, Esq.
Samuel Rogers, Esq.
Daniel Sharpe, Esq.
William Swainson, Esq.
Sam. E. Widdrington, Capt. R.E.

On the Foreign List.

Jacques Charles François Sturm.

Withdrawn from the Society.

Sir John Hall, Bart. | Edward Hawkins, Esq.

Fellows elected since the last Anniversary.

John Hutton Balfour, M.D.
Edward W. Binney, Esq.
Sir John Bowring.
Sir John Fox Burgoyne, Bart.
Philip Henry Gosse, Esq.
Robert Harkness, Esq.
Cæsar Henry Hawkins, Esq.
Manuel John Johnson, Esq.
John Carrick Moore, Esq.
Henry Minchin Noad, Esq.
Edmund Potter, Esq.
Rev. T. Romney Robinson, D.D.
Henry Hyde Salter, M.D.
Archibald Smith, Esq.
Capt. Thomas A. B. Spratt, R.N.

Foreign Members elected.

Karl Haidinger. | Antonio Secchi.

Readmitted.

Robert William Sievier, Esq.

The President then addressed the Society as follows:—

Gentlemen,

Since we last met to celebrate the Anniversary of this time-honoured Institution, events have taken place which it would be improper to pass over in silence. I allude, of course, to the occupation of Burlington House, which we owe to the liberality and due appreciation of Science of Her Majesty's Government. Your Council have already taken measures for the purpose of communicating to you the most important information respecting our proposed migration, which may be said to have already commenced, though some time must yet elapse before it can be finally completed.

As soon as Her Majesty's Government had been apprised that this Society had accepted their offer of apartments on the site in question, in conjunction with the Linnean and Chemical Societies, directions were given for commencing the necessary works, and I have the gratification of being able to announce to you, that considerable progress has already been made: the eastern wing is ready for the reception of the University, and the Great Hall is nearly completed.

The main building will be shortly delivered over to our custody; and I entertain confident hopes that the removal of the Society may take place early in the ensuing year, though the Great Hall in the west wing may not be in a fit state for painting. This, however, will not prevent its temporary occupation until such time as it may be necessary to vacate it for the purpose of its final completion.

During the recess and progress of the works, suggestions of certain alterations in the official plans have been made, some of which have been acceded to by the Government, and I have every reason to believe that no unnecessary delay will be allowed to take place in finishing all that yet remains to be done.

On such an important question as an entire change of abode, and the abandonment of a locality occupied for so many years, and, as was truly said by a distinguished Fellow of our Society, associated with many hallowed names and reminiscences, it is impossible to expect complete unanimity of opinion, and there may be some among us who still doubt the propriety of the step which has been taken; but they will, I am sure, give those who have approved of the change credit for having been actuated solely by a sincere wish to promote the interests of Science and of this Society. I still entertain the sentiments on this subject which I took the liberty of expressing on two occasions when I addressed you from this Chair; indeed I am, if possible, more than ever persuaded that great and lasting benefit will accrue to Science from our removal to a site more accessible to the great majority of our Members, and from the other advantages which must follow in its train. It has been suggested, that the two Societies about to be associated with us, should for the future hold their meetings contemporaneously with those of the Royal Society; so that on those days on which the Linnean and Chemical Societies meet, their Members may be enabled to join us in friendly converse after the business of the evening has been concluded. I hope I am not too sanguine in anticipating great advantages from these assemblies of earnest cultivators of science, devoted followers of one of the most deeply interesting and important of all human pursuits, in a building not only adorned with the portraits of some of the most distinguished men who ever shed the lustre of their genius on the country which gave them birth, but containing on its walls, in convenient juxtaposition, three scientific libraries, the accumulated treasures of ages of un-

wearied research. It cannot be but that on such a spot, and in such society, even the diligent cultivator of science will be stimulated to greater exertions.

Your Council have also adopted a measure which cannot fail to be productive of benefit to experimental philosophers. It is well known that on some occasions, when money has been voted by the Council, on the recommendation of the Government Grant Committee, for the purpose of aiding scientific researches, a part of such money has been expended on delicate apparatus, necessary for the purpose of performing the requisite experiments. It is proposed that all such instruments shall become vested in this Society for the benefit of the scientific public; and the Council hope to be enabled to set apart a room for their safe custody, and perhaps for the performance of experiments; thus in some measure reverting to the practice of ancient times; with this difference, that, whereas the apparatus of those days was necessarily primitive and rude, the Instrumental Museum about to be constituted will probably contain some of the choicest specimens of the workmanship of our most accomplished artisans.

I cannot take leave of this subject without tendering our sincere thanks to Her Majesty's Government for providing us with so convenient and central an abode, a measure which will redound no less to the honour of those who conferred, than of those who received the valuable boon.

I have before alluded to a Report of the Parliamentary Committee of the British Association, addressed to that Association at Glasgow in September 1855, in which were embodied opinions of certain eminent cultivators of Science on the question,—Whether any measures could be adopted by the Government or Parliament that would improve the position of Science or its cultivators in this country?

The discussion of this important question by a Committee of the British Association at Glasgow, was followed by a motion in the House of Commons, during the last Session, by Mr. Heywood, in which he proposed that the question should be referred to a Committee of the House of Commons. The proposal was not entertained by the House; but in the discussion which took place, Lord Palmerston is understood to have expressed himself in terms from which it might be inferred that he would be willing to take into favourable

consideration any proposal for the benefit of Science that should meet with the general approval of its most trustworthy representatives; and the matter was deferred till the ensuing Session of Parliament, with the view partly, it is believed, of permitting the question to be meanwhile maturely considered by scientific men. Under such circumstances, your Council conceived that the period was arrived in which the most ancient and venerable of all the Societies existing in this country for the cultivation of Science was called upon to take some steps for the purpose of eliciting the opinions of its most active Members on a question of such vital importance as that above referred to, and which seemed likely again to occupy the attention of the Legislature at no distant period; and accordingly, on the 11th of July last, they resolved,—

"That it was expedient that the subject should receive the attention of the Council at an early period of the next Session, and that, as a preliminary step, its consideration should be referred to the Government Grant Committee."

In pursuance of this resolution, the Government Grant Committee met, and appointed a Sub-committee, consisting of seven Members of their own Committee, together with your officers, to prepare a Report to them on the subject. That Sub-committee met on the 7th of October; and on this occasion they had before them the replies to two Circulars, requesting opinions on the above question, the one dated the 16th of July, and addressed by myself to the Members of the Government Grant Committee; the other dated the 20th of August, and addressed to the Members of the General Committee of the British Association by the Secretary of that Association, in pursuance of a resolution passed at Cheltenham on the 13th of August last.

The Sub-committee were therefore in a very favourable position for considering the various important matters involved in the question on which they were summoned to deliberate; and they devoted two successive days to the consideration of their Report under circumstances peculiarly well adapted to elicit, by prolonged discussion, apart from the formality of ordinary meetings, the views and sentiments of individual Members.

In my former Address I alluded to a proposal to constitute a new Board of Science, somewhat analogous in its functions to the late

Board of Longitude, but extending its operations to the whole domain of Science. If this question be decided in the affirmative, an ulterior one will arise, and that is,—Whether the Government Grant Committee, either organized as at present, or under a new constitution, could perform those functions and act as such a Board? The proper determination of this question involves many grave considerations, to some of which I had the honour of directing your attention in my former Address, and on which I need not again enlarge. It will be generally admitted, that the Committee has satisfactorily performed the limited duties now confided to it, of distributing the Parliamentary Grant in aid of scientific researches. It may be doubted, therefore, whether it would be prudent to interfere with their performance of *that* task for the future; and it may be advisable not to disturb in any way the present relations between this Society and the Government. It is a more difficult point, however, to determine whether it would be proper to invest your President and Council, or the Government Grant Committee appointed by them, either with or without changes in its organization, with the functions which it may be proposed to confide to the Board above mentioned. It will be admitted, that its constitution ought to be such as should inspire the cultivators of Science, and the public in general, with confidence in its administration. It ought also to be such as to ensure the confidence of Government and Parliament, so that measures recommended by it should meet with a favourable reception from them. These questions will, doubtless, receive all that mature consideration which their important bearing on the interests of Science entitles them to, and I trust that before our next Anniversary measures may be adopted with the view of carrying out some of the recommendations contained in the Report to which I have already adverted.

On a former occasion I adverted to the necessity which existed for conceding a certain amount of public support to educational establishments, for the use of those who have not the means or opportunity of studying at the Universities, where the elements of physical science might be taught on a general and systematic plan. If this were necessary at any former period, it is still more called for now, when a system of examinations, prior to the conferring of appointments, seems to be gradually taking root and likely to form an important part of our administrative organization. There seems no reason why

the examination test should be confined to those who are candidates for Government, or other public situations ; on the contrary, it seems exceedingly desirable that a plan of admitting to the privileges of an examination all applicants, who desire to be examined, should be adopted by the State. The effect of such a measure upon education generally, will undoubtedly be most beneficial. A certificate might be given to each person examined, of the extent of his acquirements. It would then be the part of employers to ascertain whether the holders of these certificates possessed in addition such qualifications as would fit them for the situations at their disposal. To such measures as those above and before recommended, together with the cooperation of the Department of Science and Art, and the unremitting exertions of the Committee of Privy Council for education, presided over by its Vice-President, or a Minister of Public Instruction, we must look for a gradual development of a more general taste for scientific studies, with its certain accompaniment, a proper appreciation of scientific acquirements and researches. Then, and then only, will Science be generally recognized by a commercial and manufacturing population, who owe everything to her applications, not only as "*the very living principle and soul of the industrial arts*," but as one of the most truly noble of all intellectual pursuits.

It is not extraordinary that those who are disposed to form a low estimate of the value of scientific research, should also entertain doubts as to the propriety of hazarding human life in its behalf. In the late discussions on the expediency of undertaking another Polar Expedition, it seemed to be assumed by some, that the well-grounded anticipation of valuable contributions to physical and geographical science, would not alone be sufficient to justify the exposing of the lives of gallant men to peril, not even of those who were most willing and anxious to be so employed, emulous of such distinction, and regardless of the risk. However this may be, it is certain that Science has sustained and does still sustain injury from the fear of offending against this popular notion, that it is wrong to hazard human life for such an object. In the case of the Polar Expedition, the risk would be very small, inasmuch as the exploration, instead of being as formerly a tentative one, embracing many thousand miles of unknown coast, would be confined to a fixed and limited locality hitherto unexplored and possessed of great scientific interest. Inde-

pendently of additions to our geographical and physical knowledge, the possible recovery of the magnetical observations, and the journals of the Franklin Expedition is a consideration of great moment, since the former must have been made by officers well trained to the task, with excellent instruments verified before the sailing of the Expedition, and in localities possessing peculiar interest in reference to the theory of magnetism; and the latter would doubtless contain a narrative of the deepest interest, not only to the cultivators of science, but to the public generally, and especially the relatives of the gallant men who are supposed to have perished. The Expedition is, however, also advocated on the score of humanity, for experienced Arctic navigators still think it not impossible that some survivors of the crews may be living among the savage tribes, whose lot is cast among those inhospitable and barren regions. But admit that there is danger in these enterprises,—Is it inglorious to perish in promoting human progress? You will not suspect me, I am sure, of being indifferent to the fate of brave men; but in fact it is well nigh impossible to add to our stock of physical knowledge without some risk to life. The Astronomer in his observatory, exposed night after night to the open air at a freezing temperature; the Chemist in his laboratory, among explosive and poisonous substances; the Surgeon who handles the dissecting knife,—all equally with the adventurous traveller expose their lives to peril. We know what was the opinion of the great Athenian moralist and martyr on this question, from that fine passage in which the dangers of military and civil life are so beautifully contrasted:—"I should have acted strangely indeed," says he, "if, having stood firmly in the post assigned to me by my general at Amphipolis, Potidæa and Delium, and braved every danger, I had turned coward and feared to die, when my God ordered me to be a philosopher and instruct mankind." Whether men perish in peace or war, if they fall in advancing civilization or arresting the progress of barbarism, what matters it whether their bones rest in a soldier's grave, or lie scattered, "as when one heweth wood," on the ice-bound shores of the Polar Sea? All are entitled to the Spartan epitaph, "Go tell our countrymen we lie here, having obeyed their commands,"—for all have alike fulfilled their mission.

Even the great Poet of the benighted middle ages introduces an

adventurous navigator addressing his crew, about to leave the narrow seas and launch out on a great and unexplored ocean, in these animating lines:—

> "Fatti non foste a viver come bruti,
> Ma per seguir virtute e conoscenza."

The interesting expedition to the Peak of Teneriffe, to which I called your attention on a previous occasion, has now been brought to a conclusion, and we may congratulate Admiral Smyth on the return of his enterprising son in safety, after having performed important services to astronomical and physical science. Great credit is due to Mr. Piazzi Smyth for the perseverance and skill with which he surmounted difficulties. The allusion to this Expedition imposes on me the pleasing duty of commemorating the liberality of Mr. R. Stephenson, M.P., in placing his yacht and her crew at the unreserved disposal of Mr. Piazzi Smyth for some months; a proceeding which deserves the grateful acknowledgments of all true lovers of science.

I understand that the value of the meteorological observations made by Mr. Smyth has been much enhanced by the excellence of the instruments supplied to the Expedition by the Board of Trade, after having been tested at that valuable establishment, the Kew Observatory.

Having had occasion to allude to this Observatory, I am sure you will be glad to hear that your Council have lately had an opportunity of proving, that their desire to uphold useful scientific undertakings is not exhibited alone in the support of establishments organized by themselves, and yielding fruits of which they reap the fame, but that they are willing to extend a helping hand wherever real Science has taken root, and has need of a friend. It had become necessary to light the Kew Observatory with gas, in order to prosecute conveniently and successfully the important processes there carried on of testing meteorological instruments for the Government and foreign nations, and the photographic registration of physical phenomena. An application was made to Government to defray the cost, estimated at £250. A long correspondence ensued, which is no bad illustration of the defects of the existing relations between Science and the Executive authorities of the State. The application was declined. Immediately upon receiving notice of this disappoint-

ment, your Council voted £250 from the Wollaston Fund to the British Association to be employed in lighting their Observatory, and the works are now in progress.

The Astronomers continue to add yearly to the catalogue of the planetary bodies of our solar system, several small planets revolving between Mars and Jupiter. The rapid progress of these discoveries is well illustrated by mentioning, that in 1852 no less than eight were discovered, in 1854 six, and in the present year five have been already added to the list; again commencing with 1847, every year has been signalized by the finding of some of these planetoids. They now amount in number to forty-two; and astronomers have found it necessary to assign, by agreement among themselves, the labour of observing a certain portion of them to particular observatories, each astronomer taking charge of, and making himself accountable for, accurate observations of some five to eight members of this curious group. Thus has a division of labour in astronomical research been fairly organized; and I cannot but think that the principle might be carried very much further with great advantage to the progress of knowledge. To take an illustration from astronomy only, on casting your eyes over the list of Observatories, both public and private, in the Nautical Almanac, you would be surprised at their number; now that list contains only a portion of the *private* observatories of this country, and such establishments are very numerous in the United States also. Now let us reflect for a moment what would be the effect if to each of these numerous observers, who is qualified for the task and possesses the necessary means, were to be allotted some one peculiar object of astronomical research, and this were pursued till the special purpose in view should be fully attained. The amount of work performed would surely be augmented to a great extent. The same principle is applicable, though perhaps in a less degree, to other departments of science. But I entertain little hope of any such scheme as that, which has been sketched out, being carried to a prosperous issue, till another revolution has taken place in Science, which I cannot but look forward to as eminently calculated to advance its progress; I mean a greater amount of intercourse between the members of the various Scientific Societies of Europe and America.

The benefits which such a measure would confer are numerous,

but time will not permit me to do more than hint at some few of them.

In the first place, then, the requirements of Science often necessitate large outlays of money on objects, the importance of which, in the present state of knowledge, can hardly be sufficiently appreciated by a majority of the members of any community. A Government, however enlightened itself, however much alive to the value of the measure suggested, may hesitate in such a case to take upon itself the responsibility of recommending that the whole cost should be borne by the particular nation whose welfare is committed to its care; this might be a step too much in advance of public intelligence and therefore likely to be condemned. Now there would seem to be no reason why, in such an instance as this, the various civilized nations should not agree to bear the cost between them; and I am persuaded, that if greater intercommunication took place between foreign cultivators of science and ourselves, this is a result at which we should at last arrive. A better illustration cannot be given of the kind of scientific undertaking, which might be thus parcelled out among various countries, than the scheme which has been for some time under discussion for establishing a reflecting telescope of considerable power in some convenient locality in the Southern Hemisphere, for the purpose of observing the Southern Nebulæ. It is not difficult to demonstrate the importance of this object. The great command of light possessed by the magnificent telescope of our late distinguished President, Lord Rosse, has enabled him to detect certain configurations in the Nebulæ visible in this country, which had escaped the notice of prior observers; I allude to the discovery of the spiral form of several of these curious objects. Now this is a fact of peculiar interest, as bearing upon important questions of physical astronomy, the question, *e. g.* whether certain laws prevailing in our own system, and even in many stellar groups comparatively near to us, extend to the very remote regions of space tenanted by the Nebulæ. Many ages may indeed elapse before these questions can be solved, but it is a duty we owe to posterity to supply the data required for solving them; and it is necessary for that purpose that accurate drawings should be now made of the present appearances of these objects, to be compared with the observations of after times. Lord Rosse is at present engaged in making detailed observations

and drawings of the appearances presented by Nebulæ visible in our own latitudes; and it is most desirable that a telescope, not much, if any, inferior in power to his, should be set up somewhere in the Southern Hemisphere to perform for the Nebulæ there visible the like office. Now the cost of such an instrument will be very considerable, and the expense will not be confined to its construction merely, but a large permanent outlay will be necessary for the maintenance of observers, and occasional repolishing of the specula, repairs, and so forth. Here is an object in which all mankind are interested, but of which the importance is not likely to be so well appreciated by the majority of even educated men, as to make them very willing to spend large sums upon carrying it out; it is therefore one to which the funds of several communities might usefully contribute a small share. Happily there are precedents for the adoption of such a course, for our Government has in one instance at least within my knowledge, and perhaps in others, liberally aided with its resources the labours of foreign men of science. Surely it is a pleasing spectacle to view several nations combining their resources to advance highly intellectual inquiries, in the success of which the whole world is concerned; and though it may not at first sight appear that any utilitarian end is likely to be promoted by the discovery of laws which prevail in regions so far removed from ourselves, still the whole history of Science shows, that useful applications are continually arising in quarters where they are most unexpected; and he who is thus deterred from prosecuting scientific discovery, in any quarter whatever, has watched the progress of the inductive sciences and the gradual growth of art to very little purpose. No knowledge of the laws of the grander phenomena of nature can possibly be a matter of indifference to us, when every day's experience more and more establishes the fact of the close analogies which subsist between all her operations. Who can say, therefore, that the lapse of ages will not reveal the effects of laws in operation in these mighty systems (where we are enabled, as it were, to take a comprehensive survey of the field of action), the observation of which may throw important light upon obscure phenomena, the mysteries of which have hitherto baffled the researches of our most acute philosophers? and once admit that these revelations *may* be made, and it may be safely predicated that a long succession of applications to

purposes of utility of the utmost importance to the well-being of the human race may follow in their train. It must be admitted that a great demand is made upon our forbearance by those who would depreciate scientific researches by the constant repetition of this senseless cry of "Cui bono." Well might one of our most distinguished philosophers, the worthy son of a renowned father, affirm, that he could not listen to it without a sense of humiliation. It is indeed incredible that so many men should be found to indulge in it in the present age, after the many astounding proofs which the history of the progress of knowledge affords, that had such sentiments prevailed in bygone times, human progress would have been almost arrested, and a very large proportion of the comforts and luxuries which we now enjoy would have been lost to mankind.

I have thus instanced one useful end which may be attained by a more extended intercourse between scientific men in different countries; I will now mention another. In the progress of the late investigations into the means of improving the relations between Science and the Government, it has occurred to me that if some conference could take place between representatives of the leading Scientific Societies of Europe and America, important information might be collected as to the general bearings of this question, by comparing the mode of dealing with it in different countries possessing administrative systems variously organized. There are many questions again of great importance to the progress of Science, as *e. g.* a liberal extension of *our* system of book-postage, which might be much advanced by prevailing on influential societies in different countries to urge their favourable consideration on their respective Governments; and it is really necessary that our energies should be directed to promoting the general diffusion of the scientific publications of all countries by every means in our power, in order that the evil may be arrested from which Science has already suffered so much; I mean the devotion of time and of talents of the most transcendent order in one country to the performance of tasks which have already been satisfactorily completed in another. I cannot but think, therefore, that periodical meetings of deputies from the principal Scientific Societies at some central spot on the continent of Europe would have a tendency to promote these and many other useful objects, which, if I were not afraid of trespassing on your patience, I might perhaps point out;

and a small portion of the funds of every Society would be well employed in defraying the cost. I will say nothing of the collateral advantages which would flow from such reunions, in making scientific men of different nations known to one another; but of this be well assured, that nothing, however seemingly trivial, which promotes good fellowship between neighbouring states,—nothing, however transitory in its duration, which brings men of different nations together in friendly and social converse on subjects of a neutral character, and altogether alien from topics which powerfully excite human passions,—can fail to exercise a most salutary influence in preserving peaceful relations and promoting the prosperity of the whole human race.

The time has now arrived when many considerations might induce me to resign the trust you have done me the honour to confide to me into your hands, but many important matters which have been undertaken since this distinguished office was conferred on me still remain unsettled; and in particular the decision of that interesting question, to which I have directed your attention,—I mean the relations which ought to subsist between Government and Science,—still hangs on the balance. As it was principally with a view of assisting in improving, if possible, those relations that I consented to accept an honour to which I felt myself unequal, so I hope to be enabled to prove, before I resign it, that on one important subject at least I have not laboured in vain.

The Copley Medal has been awarded to Professor Henry Milne-Edwards, who ranks by common consent as the most eminent living representative of the French School of Natural History; being distinguished alike for his extensive knowledge of Comparative Anatomy and Physiology, as well as of Zoology, and for the amount and value of his original contributions to these sciences. His whole career evinces the truly philosophic spirit in which he has laboured; and it would be difficult to name any existing Naturalist who has prosecuted his researches with equal success over so very wide a range of investigation.

Although Professor Milne-Edwards has furnished many valuable additions to our knowledge of the Vertebrated classes, yet it has been to the Invertebrata that his chief attention has been given; and in each of the three Cuvierian sub-kingdoms—Articulata, Mol-

lusca, and Radiata—his researches have been so important and successful, that what he has accomplished for either alone would suffice to establish for him a high scientific reputation.

His earliest labours were chiefly directed to the class *Crustacea*; of which (after having published numerous Memoirs on its various subdivisions) he produced in 1837–1840 an elaborate Monograph,—Anatomical, Physiological, and Systematic,—which is universally regarded as of pre-eminent merit, not only for its richness of detail, but also for the value of the general doctrines relating to Homologies, Development, Geographical Distribution, and other points of the highest physiological interest, which are enunciated in its pages.

The *Annelida* have also occupied much of Professor Milne-Edwards's attention; his researches on their structure, and especially on their development, were among the first, and are still among the most important of those numerous contributions which have of late added so much to our knowledge of this class; and they have served as models for all who have followed in the same path of inquiry. Some of the most important of these researches were made on the coast of Sicily, whither Professor Milne-Edwards was sent by the French Government in charge of an Expedition for the study of Marine Zoology.

His researches on the Circulation of the Mollusca, undertaken to clear up the difficulties in the asserted *phlebenterism* of the Nudibranchiata, have introduced a new and satisfactory mode of regarding the circulation of the Invertebrata generally, which throws light upon many obscurities, and solves many perplexities. Again, his researches on the Compound Ascidians have led to an entirely fresh appreciation of some of the most important points in the history of that group, which had escaped the penetration of Savigny;—more especially by making it clear that *propagation by gemmation*, which had been previously supposed to be a Zoophytic character, is equally true of the lower Mollusca; thus was the way prepared for the reception of the Bryozoa into that sub-kingdom.

The labours of Professor Milne-Edwards upon Zoophytes have not been less important or less successful than in the departments already named. He was (with his *collaborateur* M. Audouin) the first to observe and to appreciate the essential distinctions between the so-called Polypes of the *Flustra* and its allies, and the true

Zoophytes; he has done more than any other Naturalist to determine the boundaries of the group of *Polyzoa* (Bryozoa), under which these organisms—detached by common consent from the true Zoophytes—are now ranked; and by showing their very close relationship to the Compound Ascidians, he has established their title to rank in the Molluscous series.

The *True Zoophytes* have also received much of his attention; and his Monographs of various recent types of these, with his great work on the Fossil Corals of Great Britain,—executed by him (with the assistance of his friend and pupil, M. Jules Haime *) for the Palæontographical Society,—testify to the ability and success with which he has studied them.

Even in this imperfect sketch, it would be wrong to pass by Professor Milne-Edwards's admirable Memoirs on various members of the class *Acalephæ*, which are unsurpassed for their accuracy of anatomical detail and their justness of physiological deduction.

Whilst pursuing these laborious trains of original research, Professor Milne-Edwards has also been extensively engaged in the honourable work of Public Instruction; and both by his lectures and his writings he has applied himself to the diffusion of a sound taste for science through the community. And in whatever path he has followed, he has been distinguished by the same single-minded love of truth, and disregard of all selfish and personal considerations, as have pre-eminently characterized his scientific labours.

Professor Milne-Edwards,

Accept this Medal, the highest reward in our power to bestow, in token of our just appreciation of the labours of a life devoted to Natural Science, and distinguished by original views.

The Rumford Medal has been awarded to M. Pasteur for his discovery of the nature of racemic acid, and its relations to polarized light.

Chemists had long been acquainted with a peculiar acid, racemic, or paratartaric acid, which had the same composition as tartaric acid,

* M. Haime's recent death will be deeply lamented by all who were acquainted with the high promise of future distinction which he had already given.

and the same saturating power, and resembled it in its properties in a very remarkable manner. Yet the two acids were not identical, and the cause of their difference, notwithstanding their close agreement, remained a mystery. The resemblance between the two acids had been rendered still more striking on a comparison of the physical characters of their salts; for their crystalline forms were the same, their specific gravities the same, their double refraction the same. Yet the solutions of the tartrates rotated the plane of polarization of polarized light, while those of the racemates were inactive.

In a careful scrutiny of the crystalline forms of the tartrates, M. Pasteur was led to recognize the almost universal presence of hemihedral faces, of such a character that the two hemihedral forms which together make up the holohedral, were "dissymmetric," that is, could not be superposed on each other, but each could be superposed on the image of the other in a mirror. Sometimes the hemihedrism was indicated merely by the greater development of one pair of faces than of another pair. A hemihedrism of such a character that the two hemihedral forms were distinguished by right-handedness and left-handedness, seemed to be associated with the rotatory power of the solutions of the tartrates. If so, the crystals of the racemates might be expected not to exhibit the character of right- or left-handedness, since their solutions were known to be inactive on polarized light. Accordingly, on forming several of the racemates, and carefully examining the crystals, M. Pasteur found that the hemihedrism which had been observed in the tartrates was wanting in the racemates.

These patient and laborious researches in pursuit of truth were presently rewarded with an unexpected and brilliant discovery. On examining the crystals obtained in an attempt to form the double racemate of soda and ammonia, M. Pasteur observed that the crystals were hemihedral, and of two kinds, which differed only as to right-handedness and left-handedness; the one kind, which for distinction's sake may be called right-handed, absolutely agreeing with the corresponding double tartrate, the other with the image of the tartrate in a mirror. On separating the crystals of the two kinds mechanically, and dissolving them apart, the solution of the right-handed crystals was found to rotate the plane of polarization of polarized light right-handedly, like a solution of the tartrate, that of

the left-handed crystals left-handedly. These solutions yielded on evaporation, the one only right-handed, the other only left-handed crystals. The crystals of the two salts were purified by recrystallization, their acids isolated, and the chemical, optical, crystallographic, and pyroelectric properties of the acids themselves or their salts or solutions carefully compared. A like comparison was instituted between these acids and the well-known tartaric acid. The acid obtained from the right-handed crystals proved to be absolutely identical with tartaric acid in all its properties, that obtained from the left-handed crystals proved to be identical, so to speak, with the image of tartaric acid in a mirror, the two acids absolutely agreeing in all their properties except as to right-handedness and left-handedness. Where the one acid yielded crystals hemihedral right-handedly, the other yielded crystals exactly similar, except that they were hemihedral left-handedly; where the one yielded a solution rotating the plane of polarization right-handedly, the other yielded a solution rotating it left-handedly to the very same amount, and with the very same peculiar dispersion of the colours. On mixing equal quantities of the acids from the right-handed and left-handed crystals, racemic acid was reproduced.

Stimulated by this remarkable discovery, M. Pasteur has continued his labours in the same direction, and the results which he has since obtained are given in a series of papers published in the 'Annales de Chimie,' and extending nearly to the present time.

Hitherto no "active" substance (*i. e.* one whose solution has the power of rotating the plane of polarization of polarized light) has been obtained artificially from inactive substances, except in the case of the splitting up, or at least separation, of racemic acid into a right-handed and a left-handed substance; and this law seems worthy of the attention of chemists who attempt the artificial formation of the organic alkaloids. This law would have been violated had two acids which chemists had obtained from fumaric acid, an inactive substance, and which appeared to be identical with aspartic and malic acids respectively, been really so. But M. Pasteur found that these acids were inactive, unlike aspartic and malic acids, from which they also differed in some other respects.

The two acids obtained from racemic acid were found to be identical in their properties (except as to right-handedness and left-

handedness) *so long as they were mixed or combined with inactive substances only*, but M. Pasteur found that this is no longer the case when they are combined with active substances, as for example the organic alkaloids, in which case the salts obtained differ widely in solubility, crystalline form, &c.

It is to the stimulus afforded by the investigations of M. Pasteur that we must ascribe the more recent discovery by M. Marbach, that several crystals belonging to the cubical system possess the power of rotating the plane of polarization. Thus M. Pasteur's original discovery has already begun to bear fruit in discoveries made by others.

Dr. Sharpey, in the absence of the Foreign Secretary,

I request that you will transmit this Medal to M. Pasteur, in testimony of the value which we attach to his brilliant discovery.

Your Council have awarded one of the Royal Medals to Sir John Richardson. His claims to that honour as a most distinguished naturalist and scientific traveller, will I am sure be generally admitted. Sir J. Richardson's earliest work on Zoology appeared about the year 1823, but his first great work was published in 1829, namely the 'Fauna Boreali-Americana,' in which he has described the Quadrupeds and Fishes of the Arctic Regions, and with Mr. Swainson's aid, the Birds; the merits of this work, in the very accurate descriptions of the species, in the great amount of information on their habits and ranges, are admitted to be of the highest order. Since that period Sir J. Richardson has published largely on various branches of zoology, physical geography, and meteorology. His Reports to the British Association, on the Fishes of New Zealand and of China, are extremely interesting under many points of view. Another Report to the same body on the General Zoology of North America, is a most valuable contribution to science. His later works, which here must be more particularly considered, are the 'Zoology of the Voyages of the Terror and of the Herald,' in which he has described the Fishes and Reptiles collected during those expeditions, and given an account of some of the great extinct mammifers of the Arctic countries, with very interesting observations on their ancient relations and ranges. He has also lately contributed to the Geolo-

gical Journal a valuable paper, in which he has made known the presence of tertiary strata abounding with vegetable remains, in districts now rendered sterile by the extreme cold. Altogether I think there can be no doubt that the merits of Sir John Richardson, as a philosophical naturalist, are of a very high order.

It is not within our province to reward his other claims to distinction; but all will rejoice, that in the conscientious discharge of a delicate and important duty, the Council have been able to bestow a Medal on one, who has earned the applause of all who have watched his career, for his patient endurance and fortitude under incredible hardships in his first Arctic Expedition in company with Franklin, and again for his chivalrous self-devotion in the cause of friendship and science combined, at a period of life when most men resolve to rest from their labours, or at least would hesitate to encounter the fatigues and dangers of a Polar Expedition, the anticipation of which must have been more appalling to one, who had bitter experience of their painful reality.

Sir J. Richardson,

Accept this Medal as a token of our respect for your scientific labours and character.

The other Royal Medal has been awarded to Professor Thomson, whose labours in the cause of science are well known to scientific men. Yet the brief reference which can now be made to the Memoirs which he has written, will convey but an imperfect notion of the services which he has rendered; for the zeal with which he is inspired, his clear apprehension of mathematical and physical truths, and the freedom with which he communicates his ideas, have powerfully contributed to stimulate others in the pursuit of truth, and direct them into right paths. Shortly after graduating in the University of Cambridge he undertook the task of editing the Cambridge Mathematical Journal, which under his auspices was placed on an enlarged basis, under the title of the 'Cambridge and Dublin Mathematical Journal,' and is well known to the mathematicians of Europe. This Journal, as well as its predecessor the 'Cambridge Mathematical Journal,' is enriched by numerous contributions from the pen of Professor Thomson on various subjects, especially the mathematical theories

of heat, electricity, and magnetism. Among these may be mentioned a masterly article in which he has shown the compatibility of the ordinary mathematical theory of statical electricity with various phenomena which had been supposed by some to militate against it; his deduction from mathematical principles of Faraday's law relating to the motion of a small paramagnetic or diamagnetic body in a magnetic field; and his method of electrical images, first communicated to the public at the meeting of the British Association at Oxford in 1847, by which he is enabled in an extremely simple and elegant manner to solve a variety of important problems relating to the distribution of electricity on conductors.

Called to the Chair of Natural Philosophy in the University of Glasgow in the year 1846, he has ever since continued to devote himself to science in the intervals of his necessary occupations, and has worked especially at his favourite subjects of heat and electricity.

Carnot long since developed the mathematical theory of the motive power of heat in a clear and satisfactory manner, assuming as an axiom the indestructibility of heat. But the important researches of Mr. Joule have shown that this axiom must be abandoned, for that heat and work are mutually convertible. The establishment of this point necessitated a reconstruction of the mathematical theory of the motive power of heat, a theory of much practical importance from its direct bearing on the steam-engine, and this task Professor Thomson accomplished in a series of papers published in the 'Edinburgh Transactions.'

Professor Thomson and Mr. Joule have for a long time been working together, and they are now engaged in a series of experimental researches on the thermal effects of fluids in motion. The expenses attending the prosecution of these researches have been defrayed by donations from the Government Grant, and the results already obtained, drawn up partly in the form of short provisional accounts, have appeared in the 'Philosophical Transactions' and in the 'Proceedings of the Royal Society.'

In connexion with this subject may be mentioned Professor Thomson's remarkable speculation as to the cause of the light and heat of the sun, which he refers to the impact of meteoric bodies circulating around that luminary and continually falling in. The

opinion of scientific men seems to be divided as to the reception of this theory; but whatever may be thought of its truth, it has at least the merit of referring the light and heat to known causes.

The mathematical theory of magnetism was developed by the illustrious Poisson, but was made to rest on foundations in some respects too speculative. This subject has been taken up by Professor Thomson, who in a lucid and satisfactory manner has placed the theory on the basis of observed facts, so as to render it independent of any ulterior suppositions which may be adopted respecting the nature of magnetism. Two papers on this subject are published in the 'Philosophical Transactions,' and others, containing the theory of magnetic induction, are promised. More recently Professor Thomson has published a series of papers devoted to the mathematical theory of the submarine telegraph, and has been engaged in a series of experimental researches relating to voltaic electricity, which formed the subject of the Bakerian Lecture delivered in the session just concluding, and of which the detailed account will shortly be in the hands of the Fellows of the Society.

PROFESSOR THOMSON,

Accept this Medal in testimony of our admiration of your able mathematical and physical researches.

Obituary Notices of deceased Fellows.

JAQUES CHARLES FRANÇOIS STURM was born at Geneva in September 1803, of a family which had quitted Strasbourg in the middle of the last century, where one of his ancestors had been President of the Republic at the period of its contests with the Emperor Charles V., and another had attained a distinguished reputation for his writings on jurisprudence and theology. After completing his school education and his classical studies at the College with remarkable success, he became in his fifteenth year a student of the University of his native city, where his rapid progress in the study of mathematics and philosophy attracted the marked attention of the well-known geometer Simon Lhuillier, who fully anticipated the eminence which he was afterwards destined to attain.